05 50 00.01-METAL FABRICATIONS

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC05-08RL14768

ch2m
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Richland, Washington 99352
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<th>Revision</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Add Hilti Kwik-Boltz-TZ for use in cracked concrete, and show Kwik-Bolt-3 for use in un-cracked concrete. Change reference to released SGW-document number. Change page(s) 8, 18</td>
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PART 1  GENERAL

1.01  SCOPE

A. For Procurement Specification, See Section 05 50 00, Metal Fabrications.

1.02  REFERENCES

A. The following is a list of standards which may be referenced in this section:

8. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
   a. D1.1, Structural Welding Code - Steel.
   c. D1.6, Structural Welding Code - Stainless Steel.
10. ASTM International (ASTM):
    c. A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
    g. A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
h. A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

i. A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.


k. A276, Specification for Stainless Steel Bars and Shapes.

l. A278, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 Degree.

m. A283/A283M, Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

n. A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.

o. A325, Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.


q. A384, Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

r. A385, Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

s. A489, Specification for Carbon Steel Lifting Eyes.

t. A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

u. A501, Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.


w. A653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

x. A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

y. A786/A786M, Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

z. A793, Specification for Rolled Floor Plate, Stainless Steel.


ff. 632/B632M, Specification for Aluminum-Alloy Rolled Tread Plate.


hh. F436, Specification for Hardened Steel Washers.
ll. F844, Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
mm. F1554, Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

12. NSF International (NSF).
13. Occupational Safety and Health Administration (OSHA):
   b. 29 CFR 1926.105, Safety Nets.
   c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.
14. Specialty Steel Industry of North America (SSINA):
   a. Specifications for Stainless Steel.
   b. Design Guidelines for the Selection and Use of Stainless Steel.
   c. Stainless Steel Fabrication.
   d. Stainless Steel Fasteners.

1.03 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

B. Exterior Area: Location not protected from the weather by a building or other enclosed structure.

C. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

D. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

E. Submerged: Location at or below top of wall of open water holding structure, such as a basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.
1.04 SUBMITTALS

A. All submittal information shall be provided in English.

B. LEED® Building Submittal Requirements:

1. Refer to Section 01 81 13, Sustainable Design Requirements, for information regarding LEED® submission requirements.

2. The Contractor and/or Subcontractor shall submit the following costs for all Work associated with this Contract.
   a. Labor costs.
   b. Construction equipment cost.
   c. Material cost.
   d. Total construction cost (labor cost plus equipment cost plus material cost).

3. The Contractor shall submit the following information for each material type and accessory used:
   a. The percentage of post-consumer recycled content in the product by weight and the percentage of post-industrial recycled content in the product by weight. The two recycled content figures must be stated individually. Minimum recycled content shall meet the following:
      1) Steel Fabrications: 60 percent combined.
      2) Steel Studs: 30 percent combined.
   b. Manufacturing location.
   c. A Letter of Certification from the product manufacturer on the manufacturer’s letterhead verifying information submitted. The letter must indicate the following:
      1) Project name.
      2) LEED® credits under consideration:
         a) Materials and Resources Credit 4.1: Recycled content.
         b) Materials and Resources Credit 4.2: Recycled content.
         c) Materials and Resources Credit 5.1: Local/regional material.
         d) Materials and Resources Credit 5.2: Local/regional material.
   d. Product Data and Cut Sheets: Data and cut sheets shall be submitted for each product and accessory specified. Product data and cut sheets shall be marked with the Contractor’s stamp as confirmation that the submitted products are the products installed on the project.

4. LEED® Building submittal information shall be assembled into one packager per Section 01 81 13, Sustainable Design Requirements.

5. The Contracting Officer reserves the right to reject products and assemblies on the basis of incomplete or inaccurate LEED® Building submittals.

LEED—an acronym for the phrase ‘Leadership in Energy and Environmental Design’—is a registered trademark of the U.S. Green Building Council.
C. Approval Required Prior to Work Submittals:

1. Shop Drawings:
   a. Metal fabrications, including welding and fastener information.
   b. Specific instructions for concrete anchor installation, including drilled hole size, preparation, placement, procedures, and instructions for safe handling of anchoring systems.
2. Samples: Color samples of abrasive stair nosings.

D. For Information Only Submittals:

1. Concrete and Masonry Drilled Anchors:
   a. Manufacturer’s product description and installation procedures.
   c. Adhesive Anchor Installer Certification.
2. U-Channel Concrete Inserts:
   a. Manufacturer’s product description.
   b. Allowable load tables.
3. Ladders: Certification of load and fatigue tests.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Adhesive Anchor Installers: Trained and certified by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble items specified herein. Assemblies that due to necessity have to be shipped unassembled shall be packaged and tagged in manner that will protect materials from damage and will facilitate identification and field assembly.

B. Package stainless steel items in a manner to provide protection from carbon impregnation.
C. Protect painted coatings and hot-dip galvanized finishes from damage due to metal banding and rough handling. Use padded slings and straps.

D. Store fabricated items in dry area, not in direct contact with ground.

PART 2 PRODUCTS

2.01 GENERAL

A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for A36 steel), limit the maximum silicon content to 0.21 percent and the phosphorous content to 0.03 percent.

B. Unless otherwise indicated, meet the following requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>ASTM Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Shapes and Plates</td>
<td>A36/A36M</td>
</tr>
<tr>
<td>Steel Pipe</td>
<td>A501 or A53/A53M, Type E or S, Grade B</td>
</tr>
<tr>
<td>Structural Steel Tubing</td>
<td>A500, Grade B</td>
</tr>
<tr>
<td>Stainless Steel:</td>
<td></td>
</tr>
<tr>
<td>Bars and Angles</td>
<td>A276, AISI Type 316 (316L for welded connections)</td>
</tr>
<tr>
<td>Shapes</td>
<td>A276, AISI Type 304 (304L for welded connections)</td>
</tr>
<tr>
<td>Steel Plate, Sheet, and Strip</td>
<td>A240/A240M, AISI Type 316 (316L for welded connections)</td>
</tr>
<tr>
<td>Bolts, Threaded Rods,</td>
<td>F593, AISI Type 316, Condition CW</td>
</tr>
<tr>
<td>Anchor Bolts, and Anchor Studs</td>
<td></td>
</tr>
<tr>
<td>Nuts</td>
<td></td>
</tr>
<tr>
<td>Steel Bolts and Nuts:</td>
<td></td>
</tr>
<tr>
<td>Carbon Steel</td>
<td>A307 bolts, with A563 nuts</td>
</tr>
<tr>
<td>High-Strength</td>
<td>A325, Type 1 bolts, with A563 nuts</td>
</tr>
<tr>
<td>Anchor Bolts and Rods</td>
<td>F1554, Grade 55, with weldability supplement S1.</td>
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<tr>
<td>Eyebolts</td>
<td>A489</td>
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<tr>
<td>Threaded Rods</td>
<td>A36/A36M</td>
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<table>
<thead>
<tr>
<th>Item</th>
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<tr>
<td>Flat Washers (Unhardened)</td>
<td>F844</td>
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<tr>
<td>Flat and Beveled Washers (Hardened)</td>
<td>F436</td>
</tr>
<tr>
<td>Thrust Ties for Steel Pipe:</td>
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</tr>
<tr>
<td>Threaded Rods</td>
<td></td>
</tr>
<tr>
<td>Nuts</td>
<td></td>
</tr>
<tr>
<td>Plate</td>
<td>A193/A193M, Grade B7</td>
</tr>
<tr>
<td>Welded Anchor Studs</td>
<td>A194/A194M, Grade 2H</td>
</tr>
<tr>
<td></td>
<td>A283/A283M, Grade D</td>
</tr>
<tr>
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<td>A108, Grades C-1010 through C-1020</td>
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<tr>
<td>Aluminum Plates and Structural Shapes</td>
<td>B209 and B308/B308M,</td>
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<td></td>
<td>Alloy 6061-T6</td>
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<tr>
<td>Aluminum Bolts and Nuts</td>
<td></td>
</tr>
<tr>
<td>Cast Iron</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F468, Alloy 2024-T4</td>
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<tr>
<td></td>
<td>A48, Class 35</td>
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C. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on Drawings.
2. Material type and protective coating as shown in Fastener Schedule at end of this section.

B. Anchor Bolt Sleeves:

1. Plastic:
   a. Single unit construction with corrugated sleeve.
   b. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
   c. Material: High density polyethylene.
   d. Manufacturer: Sinco Products, Inc., Middletown, CT, (800) 243-6753.

2. Fabricated Steel: ASTM A36/A36M.
2.03  CONCRETE AND MASONRY DRILLED ANCHORS

A. General:

1. AISI Type 316 stainless, hot-dip galvanized, or zinc-plated steel, as shown in Fastener Schedule at end of this section.
2. Current evaluation and acceptance reports by ICC or other similar code organization.

B. Wedge Anchors:

1. Manufacturers and Products:
   a. ITW Ramset/Red Head, Addison, IL; Trubolt Wedge Anchor.
   b. Hilti, Inc., Tulsa, OK; Kwik-Bolt-3 (KB-3) Anchor (for un-cracked concrete), or Kwik-Bolt-TZ Anchor (for cracked concrete).
   d. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Wedge-All Anchor.
   e. Wej-It Corp., Tulsa, OK; ANKRtite Wedge Anchor.
   f. Adhesives Technology, Pompano Beach, FL; Kingpin Wedge Anchor.
   g. Unitex, Kansas City, MO; Pro-Poxy 300 and Pro-Poxy 300 Fast Epoxy Adhesive Anchors.

C. Expansion Anchors:

1. Self-drilling anchors, snap-off or flush type, zinc-plated.
2. Nondrilling Anchors: Flush type for use with zinc-plated or stainless steel bolt, or stud type with projecting threaded stud.
3. Manufacturers and Products:
   a. ITW Ramset/Red Head, Addison, IL; Multi-Set II Drop-In and SelfDrill Anchor.
   b. Hilti, Inc., Tulsa, OK; Hilti HDI Drop-In Anchor.
   c. Powers Fasteners, New Rochelle, NY; Steel Drop-In Anchor.
   d. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Drop-In Anchor.

D. Undercut Anchors:

1. Manufacturers and Products:
   a. USP Structural Connectors; DUC Undercut Anchor.
   b. Hilti, Inc., Tulsa OK; HDA Undercut Anchor.

E. Sleeve Anchors:

1. Manufacturers and Products:
   a. ITW Ramset/Red Head, Addison, IL; Dynabolt Hex Nut Sleeve Anchor.
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c. Simpson Strong –Tie Co., Inc, Pleasanton, CA; Sleeve-All Hex Head Anchor.
d. Wej-It Corpo., Tulsa, OK; Wej-It Sleeve Anchor.
e. Hilti, Inc., Tulsa, OK; HSL-3 Heavy Duty Sleeve Anchor.

F. Adhesive Anchors:

1. Threaded Rod:
   a. ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
   b. Length as require, to provide minimum depth of embedment.
   c. Clean and free of grease, oil, or other deleterious material.
   d. For hollow-unit masonry, provided galvanized or stainless steel wire cloth
      screen tube to fit threaded rod.

2. Adhesive:
   a. Two-component, designed to be used in adverse freeze/thaw
      environments, with gray color after mixing.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended
      use and environmental conditions.
   c. Nonsag, with selected viscosity base on installation temperature and
      overhead application where applicable.

3. Packing and Storage:
   a. Disposable, self-contained cartridge system capable of dispensing both
      components in proper mixing ration and fitting into a manually or
      pneumatically operated caulking gun.
   b. Store adhesive cartridges on pallets or shelving in covered storage area, in
      accordance with manufacturer’s name, product name, material type, batch
      or serial number, and adhesive expiration date.
   c. Dispose of cartridges if shelf life has expired.

4. Manufacturers and Products:
   a. Adhesives Technology, Pompano Beach, FL; Ultrabond 1 Epoxy Anchor
      System.
   b. Hilti, Inc., Tula, OK; HIT RE 500-SD or HIT-HY-ISO-MAX-5D
      Adhesive Anchor System, (use HIT HY 20 for hollow masonry).
   c. ITW Ramset/Red Head, Addison, IL; C6 Adhesive Anchor System or A7
      Adhesive Anchor System. (Use A7 Adhesive Anchor System for hollow
      masonry).
   d. Simpson Strong-Tie Co., Inc., Pleasanton, CA; ET Epoxy-Tie Adhesive or
      Acrylic-Tie Adhesive. (Use Acrylic-Tie-Adhesive for temperatures below
      40 degrees F.)
   e. Unitec, Kansas City, MO; Pro-Poxy 300 Adhesive Anchors or Pro-Poxy
      300 Fast Epoxy Adhesive Anchors.
G. Adhesive Threaded Inserts:

1. Stainless steel, internally threaded insert.

2.04 WELDED ANCHOR STUDS

A. Headed anchor studs (HAS) or threaded anchor studs (TAS), as indicated on Drawings.
   1. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semikilled or killed aluminum or silicon dioxidation, unless indicated otherwise.
   2. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.

B. Manufacturers:
   1. Nelson Stud Welding, FabriSteel Co., Elyria, OH.

2.05 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

2.06 U-CHANNEL CONCRETE INSERTS

A. Rolled ASTM A240/A240M, AISI Type 316 stainless steel, 0.105-inch thickness, 1-5/8-inch width by 1-3/8-inch depth, with stainless steel anchors at 10-inch maximum spacing, styrofoam fillers, and end caps.

B. Nut and Bolt Hardware: Type 316 stainless steel, 5/8-inch minimum diameter, unless indicated otherwise. Manufacturer’s standard to match insert.

C. Manufacturers and Products:
   1. Power-Strut, Wayne, MI; PS 349 Series.
   2. B-Line Systems, Inc., Highland, IL; B32 Series.
   3. Halfen Anchoring Systems, Converse, TX; Channel Type 4141HTA.
2.07 ABRASIVE NOSING FOR STAIRS

A. Unless otherwise shown on Drawings, furnish flush type abrasive nosings on stairs.

B. Nosing Components:

1. Homogeneous epoxy abrasive, with minimum 50 percent aluminum oxide content, formed and cured upon an extruded aluminum base.
2. Epoxy abrasive shall extend over and form curved front edge of nosing.

C. Anchoring System: Double-set anchors consisting of two rows of integrally extruded anchors.

D. Size: 3 inches wide by 1/4 to 3/8 inch thick by length as shown.

E. Color: Selected by Engineer from manufacturer's standard color range.

F. Manufacturers and Products: American Safety Tread Co., Inc., Helena, AL; Type FA-311D.

2.08 FLOOR PLATE

A. Material:

1. Galvanized Steel: Carbon steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
2. Stainless Steel: ASTM A793, AISI Type 304.

B. Minimum Thickness:

1. Steel: 1/4 inch, unless shown otherwise on Drawings.
2. Aluminum: 3/8 inch, unless shown otherwise on Drawings.

C. Surface shall be raised-lug pattern or diamond tread, unless shown otherwise on Drawings.

D. Slip-Resistant Surface:

1. Provide where indicated on Drawings.
2. Manufacturers and Products:
   a. IKG/Borden, Clark, NJ; MEBAC 2.
   b. W.S. Molnar Co., Detroit, MI; SLIPNOT Grade 2–Medium.
2.09 LADDERS

A. Fabricate ladders with rails, rungs, landings, and cages to meet applicable requirements of OSHA, CFR Part 1910.27, and ALI A14.3.

1. Concentrated load of 250 pounds plus 30 percent impact on rungs.
3. Concentrated load of 250 pounds plus 30 percent impact between consecutive attachments.
4. Self-closing gates at landings.

B. Flat Bar Ladders:

1. Punch rails, pass rungs through rails, and weld on outside.
2. Weld brackets to the ladder for fastening ladder to wall.

2.10 SAFETY CLIMB DEVICE

A. Application: Provide for each ladder where unbroken height between levels exceeds or is equal to 6 feet.

B. General:

2. Belt and harness shall withstand minimum drop test of 250 pounds in 6-foot free fall.
3. Fall Prevention System Material: Hot-dip galvanized steel in accordance with ASTM A123/A123M.

C. Components and Accessories:

1. Main Components: Sleeve or trolley, safety harness, and carrier or climbing rail.
2. Ladder rung clamps with hot-dip galvanized steel mounting brackets and hardware.
3. Removable extension kit with tiedown rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

D. System Fabrication:

1. Install in accordance with manufacturer’s instructions.
2. Furnish additional accessories required to complete the system for each ladder.
3. Furnish one harness for each ladder equipped with a safety climb device.
4. Furnish pivot section at platforms, landings, and roofs.
5. When installed to required height, fall prevention system shall be rigid and an integral part of the structure.

E. Manufacturers and Products:

1. Miller Equipment, Franklin, PA; Sure Track Rail System.
2. TS Products, St. Charles, IL; TS Safety Rail System.

2.11 LADDER CLIMB PREVENTION SHIELD

A. Application: Provide for each ladder exposed in an exterior location.

B. Eight feet long with angled sides to within 2 inches of wall when closed.

C. Furnish dissimilar metals protective coatings at bolted connections.

D. Manufacturer and Product: North Safety Products, Specialty Products Division, Toronto, Ontario, Canada; Ladder Gate 770-000-001.

2.12 SHELL MANHOLE:

A. Flanged and bolted type with confined rubber gasket.

B. Manhole Unit: Capable of withstanding pressure of full tank of water with no leakage.

C. Minimum clear opening of 24 inches.

D. Cover: Hinged to tank.

E. Grind welds and sheared edges smooth.

2.13 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:

1. Resists washout.
2. Manufacturers and Products:
   a. Bostik, Middleton, MA; Neverseez
   b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize

B. Neoprene Gasket:

1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
2. Thickness: Minimum ¼ inch.
2.14 FABRICATION

A. General:

1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
2. Finish necessary rabbets, lugs, and brackets so work can be assembled in neat substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:

1. Use steel shapes, unless otherwise noted.
2. Steel to be hot-dip galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 and 0.25 percent.
3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures – Allowable Stress Design.

C. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Steel: Meet fabrication requirements of AWS D1.1, Section 5.
4. Aluminum: Meet requirements of AWS D1.2.
5. Stainless Steel: Meet requirements of AWS D1.6.
6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1, Section 7, and manufacturer’s instructions.
7. Complete welding before applying finish.

D. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

F. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143, ASTM A384, and ASTM A385. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

G. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.15 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct any deficiencies.

1. Steel: AWS D1.1, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.

B. Hot-Dip Galvanizing:

1. An independent testing agency, will be retained by CHPRC, shall be retained by Contractor and approved by Buyer’s Technical Representative (BTR) to inspect and test hot-dip galvanized fabricated items, except in accordance with ASTM A123/A123M and ASTM A153/A153M.
2. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123/A123M and ASTM A153/A153M.
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3. Reject and retest nonconforming articles in accordance with ASTM A123/A123M and ASTM A153/A153M.

PART 3  EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:
   1. Install metal fabrications plumb or level, accurately fitted, free from distortion or defects.
   2. Install rigid, substantial, and neat in appearance.
   3. Install manufactured products in accordance with manufacturer’s recommendations.
   4. Obtain Buyer’s Technical Representative (BTR) approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:
   1. Do not remove mill markings from concealed surfaces.
   2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
   3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

C. Pipe Sleeves:
   1. Provide where pipes pass through concrete or masonry.
   2. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls.
   3. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
   4. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

D. Steel Lintels and Shelf Angles: Provide as required for support of masonry and other construction not attached to structural steel framing, unless otherwise shown on Drawings.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Accurately locate and hold anchor bolts in place with templates at the time concrete is placed.

B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.
C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.03 CONCRETE AND MASONRY DRILLED ANCHORS

A. Begin installation only after concrete or masonry to receive anchors has attained design strength.

B. Install in accordance with manufacturer’s instructions.

C. Provide minimum embedment, edge distance, and spacing as follows, unless indicated otherwise by anchor manufacturer’s instructions or shown otherwise on Drawings:

<table>
<thead>
<tr>
<th>Anchor Type</th>
<th>Min. Embedment (bolt diameters)</th>
<th>Min. Edge Distance (bolt diameters)</th>
<th>Min. Spacing (bolt diameters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wedge</td>
<td>9</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Expansion and Sleeve</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Undercut</td>
<td>9</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Adhesive</td>
<td>9</td>
<td>9</td>
<td>13.5</td>
</tr>
</tbody>
</table>

D. Use only drill type and bit type and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and compressed air.

E. For undercut anchors, use special undercutting drill bit and rotary hammer drill and apply final torque as recommended by anchor manufacturer.

F. When embedded steel or rebar is encountered in the drill path, slant drill to clear obstruction. If drill must be slanted more than 10 degrees to clear obstruction, notify BTR for direction on how to proceed.

G. Adhesive Anchors:

1. Do not install adhesive anchors when temperature of concrete is below 40 degrees F (25 degrees F for Simpson Strong-Tie Acrylic-Tie Adhesive) or above 100 degrees F.
2. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry where required by manufacturer’s instructions.
3. For hollow-unit masonry, install screen tube in accordance with manufacturer’s instructions.
4. Do not disturb anchor during recommended curing time.
5. Do not exceed maximum torque as specified in manufacturer’s instructions.
3.04 U-CHANNEL CONCRETE INSERTS

A. Provide as indicated for pipe supports and where otherwise shown on Drawings.

B. Except for interior dry areas, use plastic clips or similar dielectric material to isolate channel anchors from concrete reinforcing steel.

3.05 ABRASIVE NOSINGS

A. Provide abrasive nosings on concrete steps not being supplied or coated with another type of nosing or nonskid material.

3.06 SAFETY CLIMB DEVICE SYSTEM

A. Provide for each ladder where unbroken height between levels exceeds 20 feet, or at lesser height where indicated on Drawings.

B. Install in accordance with manufacturer’s instructions.

C. Furnish additional accessories required to complete the system for each ladder.

D. Furnish one harness for each ladder equipped with a safety climb device.

E. Furnish pivot section at platforms, landings, and roofs.

F. When installed to required height, fall prevention system shall be rigid and an integral part of the structure.

3.07 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel:

1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in SGW-54024, Painting and Coating, unless indicated otherwise.

2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

3. Allow coating to dry before installation of the material.

4. Protect coated surfaces during installation.

5. Should coating become marred, prepare and touch up in accordance with paint manufacturer’s written instructions.

B. Titanium: Where titanium equipment is in contact with concrete or dissimilar metal, provide full-face neoprene insulation gasket, 3/32-inch minimum thickness and 70-durometer hardness.
C. Stainless Steel:

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.08 PAINTING AND REPAIR OF GALVANIZED STEEL

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.

B. Repair of Damaged Hot-Dip Galvanized Coating:

1. Conform to ASTM A780.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780.
4. Use magnetic gauge to determine that thickness is equal to or greater than the base galvanized coating.

3.09 FIELD QUALITY CONTROL

A. Welded Anchor Studs:

1. At start of each production period, Contractor shall perform the following test to determine proper generator, control unit, and stud welding gun settings, in accordance with AWS D1.1, Chapter 7:
   a. Weld two test studs and visually inspect for full 360-degree flash.
   b. Bend test studs 30 degrees from vertical for headed anchor studs (HAS). Torque test threaded anchor studs (TAS) studs per AWS D1.1, Section 7.6.6.2.
   c. Test studs will be acceptable if there is no failure of welds. d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.
   d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.
2. During production, if visual inspection reveals that weld does not exhibit full 360-degree flash or that stud has been repaired by welding, Contractor shall perform the following test in accordance with AWS D1.1, Chapter 7:
   a. HAS studs, bend stud approximately 15 degrees from vertical, away from missing portion of flash. For TAS studs, torque test per AWS D1.1, Section 7.6.6.2.
   b. Studs meeting this test without exhibiting cracks in weld will be considered acceptable and left in bent position.
   c. Replace studs failing test.

3. Remove all ferrules from welded anchor studs prior to inspection and placement of concrete.

B. Concrete and Masonry Drilled Anchors: Special inspection and testing will be provided as indicated on Drawings.

3.10 MANUFACTURER’S SERVICES

A. Adhesive Anchors: Conduct site training of installation personnel for proper installation, handling, and storage of adhesive anchor system. Notify BTR of time and place for sessions.

3.11 FASTENER SCHEDULE

A. Unless indicated otherwise on the Drawings, provide fasteners as follows:

<table>
<thead>
<tr>
<th>Service Use and Location</th>
<th>Product</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings</td>
<td>Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise.</td>
<td></td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Stainless steel headed anchor bolts.</td>
<td></td>
</tr>
<tr>
<td>Exterior and Interior Wet Areas</td>
<td>Stainless steel headed anchor bolts with fusion bonded coating</td>
<td>See Section 09 90 00, Painting and Coating</td>
</tr>
<tr>
<td>Service Use and Location</td>
<td>Product</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>2. Anchor Bolts Cast Into Concrete for Equipment Bases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Stainless steel headed anchor bolts, unless otherwise specified with equipment</td>
<td></td>
</tr>
<tr>
<td>Submerged, Exterior, Interior Wet, and Corrosive Areas</td>
<td>Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment</td>
<td>See Section 09 90 00, Painting and Coating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Drilled Anchors for Metal Components to Cast-in-Place Concrete (e.g., Ladders, Handrail Posts, Electrical Panels, and Equipment)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Dry Areas</td>
<td>Zinc-plated or stainless steel wedge or expansion anchors</td>
<td>Use zinc-plated undercut anchors for overhead and ceiling installations.</td>
</tr>
<tr>
<td>Submerged, Exterior, Interior Wet, and Corrosive Areas</td>
<td>Adhesive stainless steel anchors</td>
<td>Use stainless steel undercut anchors for overhead and ceiling installations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Anchors in Grout-Filled Concrete Masonry Units</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Hot-dip galvanized steel headed anchor bolts, zinc-plated or stainless steel sleeve anchors, or stainless steel adhesive anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5. Anchors in Hollow Concrete Masonry Units</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Zinc-plated or stainless steel sleeve anchors, or stainless steel adhesive anchors with screen tube</td>
<td></td>
</tr>
<tr>
<td>Service Use and Location</td>
<td>Product</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>6. Connections for Structural Steel Framing</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>High-strength steel bolted connections</td>
</tr>
<tr>
<td>7. Connections for Steel Fabrications and Wood Components</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Hot-dip galvanized carbon steel bolted connections</td>
</tr>
<tr>
<td>8. Connections of Aluminum Components</td>
<td>Submerged, Exterior and Interior Wet and Dry Areas</td>
<td>Stainless steel bolted connections, unless otherwise specified with equipment</td>
</tr>
<tr>
<td>9. All Others</td>
<td>Exterior and Interior Wet and Dry Areas</td>
<td>Stainless steel fasteners</td>
</tr>
</tbody>
</table>

B. Antiseizing Lubricant: Use on all stainless steel threads.

C. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.